

# PreCalculus

## Mountains of Hawaii

Name \_\_\_\_\_

Period \_\_\_\_\_

*The following should be solved on a separate sheet of paper.*

A business executive from a large travel company with a strong desire for the perfect brochure has called in your consulting firm for help in labeling a photograph taken on a clear day from the southeast shore of Oahu. He shows you the photograph in which you see mostly sea and sky. But on the horizon are three mountain peaks, equally spaced and apparently all of the same height. The executive tells you that the t-shirt vendor at the beach informed him that the three mountain peaks are the volcanoes of Lanai, Maui, and the Big Island (Hawaii). The vendor even added, “You almost never see the Big Island from here.”



The business executive thinks this photograph may be a great cover photograph for the brochure. He has some misgivings, however. He is wondering if, in fact, it is ever possible to see the Big Island from Oahu. He wants accurate labels on the photograph before it goes to print, so he asks for your help.

You realize that some trigonometry is needed as well as a good atlas and encyclopedia. After doing some research you discover the following fact chart about the volcano peaks in the Hawaiian Island Chain.

Island	Distance (Miles)	Mountain	Height (Feet)
Lanai	65	Lanaihale	3,370
Maui	110	Haleakala	10,023
Hawaii	190	Mauna Kea	13,796
Molokai	40	Kamakou	4,961

*Source:* Hawaii Department of Natural Resources

These distances, measured along the surface of the Earth, represent the length of the arc that originates at sea level on Oahu and terminates in an imaginary location directly below the peak of each mountain at what would be sea level.



1. These volcanic peaks are all different heights. If your client took a photo of these three mountain peaks that all look the same height, how could they possibly represent these three volcanoes?
2. The radius of the Earth is approximately 3,960 miles. Based on that figure, what is the circumference of the earth? How is the distance between islands related to the circumference of the earth?
3. To determine which of these mountain peaks would actually be visible from Oahu, you need to consider that the photographer standing on the shore and looking “straight out” would have a line of sight tangent to the surface of the earth at that point. Make a rough sketch of the right triangle formed by the tourist’s line of sight, the radius from the center of the earth to the photographer, and a line from the center of the earth that passes through Mauna Kea. Determine the angle formed at the center of the earth.
4. Looking at your triangle from the previous question, decide which side represents the hypotenuse of the triangle. Can you use the information you have now to determine whether or not Mauna Kea would be visible from Oahu?
5. Repeat this procedure with the information about Maui and Lanai. Will they be visible from Oahu?
6. There is another island off Oahu that the t-shirt vendor did not mention. Molkai is about 40 miles from Oahu, and its highest peak, Kamakou, is 4,961 ft above sea level. Would Kamakou be visible from Oahu?
7. Your team should now be prepared to name the three volcanic peaks in the photograph. What could you do to figure out which one is which (reading left to right)?